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C-A OPERATIONS PROCEDURES MANUAL

12.31 Hazards in the NII

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Hand Processed Changes

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Approved: _____ ***Signature on File*** _____
Collider-Accelerator Department Chairman Date

M. Wiplich

12.31 Hazards in the NII

1. Purpose

This document describes some of the hazards associated with the operation negative ion injectors.

2. Responsibilities

It is the responsibility of the person or persons executing this procedure to observe all safety rules

3. Prerequisites

The person or persons executing this procedure shall have all formal training required of a TVDG Operator.

4. Precautions

Precautions are given in the procedure.

5. Procedure

5.1 Hazards

5.1.1 **Radiological** - Upon removing an ion source, or any component that allows access to areas normally at vacuum, there may be a possibility of coming into contact with radioisotopes that have been previously accelerated, notably Carbon-14 and Uranium. When an NII is at atmospheric pressure, any openings to the vacuum system shall be covered whenever possible. Personnel should wear disposable gloves when working with NII vacuum components. Health Physics shall be called to survey for contamination if a vacuum pump used on MP7 NII is to be rebuilt or shipped.

5.1.2 **Chemical** - Some target materials are toxic or highly reactive. An ion source may contain dangerous quantities of cesium or other highly reactive metals.

5.1.2.1 All targets used on any ion source shall be labeled. Specific hazards associated with substances used for targets and other substances found in the NII are described in the MSDS for that substance. Copies of MSDSs for commonly used materials are kept in the Tandem Control Room. MSDSs can be obtained from the [BNL MSDS Database](#). Operators not acquainted with a particular substance are urged to check the aforementioned references for special handling that may be required. In

the event that an ion source is partially disassembled in the NII, cesium or some other reactive material may now be exposed to air. Operators should never look directly into a boiler. Examine a boiler assembly through a Plexiglass shield, and if working on uncleaned source parts, use gloves.

- 5.1.3 **Physical** - The physical hazards associated with the NIIs are the same as any other area in the accelerator vault area. There may be low clearance, sharp objects, or trip hazards present.

5.1.3.1 The NIIs are to be kept free of clutter. The glass pipe at the entrance to the MP7 NII has cushioning on it, to protect personnel from possible head injury.

- 5.1.4 **Electrical** - There are numerous sources of dangerous voltages and currents present in the NIIs which may be live even with the cage door open. Extreme caution shall be exercised by personnel whenever inside either of the NII cages. Observe the two-man rule if live circuits are present.

<p style="text-align: center;"><u>Note:</u> NO PERSON MAY ENTER AN ELECTRICALLY-POWERED NII ALONE!</p>
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- 5.1.4.1 Personnel may enter the NII cage alone only if both the Isolation Transformer and Preaccel Power Supply are OFF. The NII cage door shall remain open and at least one NII Interlock Switch shall be activated during the time personnel remain in the cage alone. Personnel entering an NII cage while power is still on (2 persons required) shall insure that the Preaccel Table and the Extraction Bridge are grounded the entire time that personnel are in the cage. This is accomplished by an active grounding system that engages as the door opens. Grounding straps shall also be connected to the extraction bridge and preaccel table. Operators shall use good electrical safety practice and turn off power as required to insure personnel safety. The normal connections for each type of source and the voltages present for the various sources are shown in the following table:

Normal MP7 NII Source Wiring

SRCE CONF.	VOLTAGE	NAME	MP7 BRKR	MP7 VARIAC
860-DC	0-10KVDC	CsACCEL	PROBE	GAS LEAK (CONTROL)
	0-110VAC	IONIZER	FILAMENT	FILAMENT
	0-110VAC	BOILER	ARC	ARC
860-PULSED	5KV PULSE	PULSE	PROBE	PROBE*
	0-200VDC	TRACE	MAGNET	MAGNET
	0-110VAC	IONIZER	FILAMENT	FILAMENT
	0-110VAC	BOILER	ARC	ARC
UNISOURCE	300VDC	DECEL	ARC	ARC
	0-110VAC	IONIZER	MAIN	NORTH PREACCEL
	0-110VAC	BOILER	FOCUS	FOCUS/BOILER
He SOURCE	0-300VDC	ARC	ARC	ARC
	0-220VAC	FILAMENT	FILAMENT	FILAMENT
	0-110VAC	MAGNET	MAGNET	MAGNET
	0-110VAC	BOILER	BOILER	BOILER

Normal MP6 NII Source Wiring

SRCE CONF.	VOLTAGE	NAME	MP6 BRKR	MP6 VARIAC
860-DC	0-10KVDC	CsACCEL	PROBE	GAS LEAK (CONTROL)
	0-110VAC	IONIZER	FILAMENT	FILAMENT
	0-110VAC	BOILER	ARC	ARC
860-PULSED	5KV PULSE	PULSE	PROBE	PROBE
	0-1KVDC	TRACE	MAGNET	MAGNET
	0-110VAC	IONIZER	FILAMENT	FILAMENT
	0-110VAC	BOILER	ARC	ARC
UNISOURCE	300VDC	DECEL	ARC	ARC
	0-110VAC	IONIZER	MAIN	NORTH PREACCEL
	0-110VAC	BOILER	FOCUS	FOCUS/BOILER
He SOURCE	0-300VDC	ARC	ARC	ARC
	0-220VAC	FILAMENT	FILAMENT	FILAMENT
	0-110VAC	MAGNET	MAGNET	MAGNET
	0-110VAC	BOILER	BOILER	BOILER

**Not shorted to ground by the automatic grounding system activated by the cage door.*

5.1.4.2 In addition to the above, the following voltages are also present in the NII:

NAME	VOLTAGE
Extraction	0-80 KVDC
Einzel Lens	0-30 KVDC
Inflector Magnet	0-300 ADC
Suppressor	
Steerers	0 +/- 5 KVDC
Focus	0-50 KVDC

5.1.4.3 Any wire shall be presumed live unless proven otherwise. No uncovered 440vac equipment or lines are permitted in the NIIs. In addition to the above list, there may be other voltages present on variacs and other devices in the NIIs. All power can be removed by shutting down the Isolation Transformer. Power from the Preaccel Breaker Distribution Panel to the remainder of the NII can be removed with the Main Breaker. The Primary Source Breaker will remove all power to the Extraction Bridge. In the event of an emergency, all power can be removed from the NIIs with any Emergency Stop Button, or any Red Interlock Switch in or under the NIIs. In addition to the three Red Interlock Switches in the NII cages, there are two Interlock Switches located in the accelerator pits, directly under the NIIs. Activating any one of the Red Interlock Switches will shut down the Isolation Transformer, the Source Steerers, and the Preaccel Power Supply. Depressing any Emergency Stop Button will shut off the Chains and Shafts of both machines in addition to removing power from the aforementioned devices: It is the operators' responsibility to know the location of these Interlock Switches.

6. **Documentation**

None

7. **References**

None

8. **Attachments**

None